

**A STUDY ON THE EFFECTS OF PARTIAL REPLACEMENT OF
CEMENT WITH GLASS POWDER AND FINE AGGREGATES WITH
SAWDUST IN CONCRETE**

Submitted in partial fulfilment of the requirements

Of the degree of

MASTER OF TECHNOLOGY

In

STRUCTURAL ENGINEERING

By

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2017

CERTIFICATE

This is to certify that the project work entitled “**A STUDY ON THE EFFECTS OF PARTIAL REPLACEMENT OF CEMENT WITH GLASS POWDER AND FINE AGGREGATES WITH SAWDUST IN CONCRETE**” being submitted by Mr. A SURYA VAMSHI (11604618), has been carried out under my supervision and has not been submitted to any other institute or university for award of any degree.

Signature of guide

Mr. Ashfaq Malik

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DECLARATION

I hereby declare that the dissertation entitled, **“A STUDY ON THE EFFECTS OF PARTIAL REPLACEMENT OF CEMENT WITH GLASS POWDER AND FINE AGGREGATES WITH SAWDUST IN CONCRETE”**

submitted for the M.Tech degree is entirely my original work and all ideas and references have been duly acknowledge. It does not contain any work for the award of any other degree or diploma.

Date: 30/11/2017

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Any accomplishment requires the efforts of people and, this is not different. So it also been complete with cooperation of many persons. I am thankful to guide **“Mr. Ashfaq Malik”** for giving me the opportunity to do this wonderful research on the topic **“A STUDY ON THE EFFECTS OF PARTIAL REPLACEMENT OF CEMENT WITH GLASS POWDER AND FINE AGGREGATES WITH SAWDUST IN CONCRETE”**, which also helped me in doing a lot of Research and I came to know about so many new things.

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ABSTRACT

Concrete is a substance which comprises of mixture of cement, aggregates, water and admixtures. Right now a being, a set of researchers are ready around the globe, by the exercise of countless fallow materials. In this thesis, discarded flute powder is second-hand as a half-done alternate of stick in concrete. The cement substituted at different percentages. In this report, we study the effect to micron and other between of particle size of glass powder in set of ranges one less than 75 micron and other in between 75 to 300 microns. It is discarded that the preliminary potency obtained from the supplement of tumbler powder is enormously a smaller amount on seventh day and progressively increases to 28 days. It is obtained that 15% has enough strength especially of size less than 75 micron provides high strength. The properties of concrete made with sawdust were also studied and checked for compressive strength for different mix.. The workability obtained is between a ranges of 16mm to 122 mm. For each control mix, mix with fine aggregates was replaced by standard percentage of saw dust 15%.The effect of saw dust on the workability, compressive strength, tensile strength, modulus of elasticity were also studied.

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CHAPTER 1

INTRODUCTION:

Definite is a substance which comprises of mixture of cement, aggregates, dampen and admixtures. Straight away a being luck of researches are departure around the globe, by the apply of lots of equipment like take to the air ash, silica fume, rice case ash, rubber tyres, etc. These surplus equipment are second-hand as space filler equipment in concrete. Wineglass is old in distinctive customs in our day to day excitement and it of the project, just about the entire industries produce waste. In that barely 5% of waste away equipment are recycled every day around globe.

Approachability of fasten together is reducing these living and behave added exorbitant. Weaken goblet will be a decision for distinct industry. Tumbler is old in our day to day kick and it has confined span and after that it will be sent to landfills. Since the wineglass is non-biodegradable, landfills don't give eco-friendly, consequently in attendance is a protected senses to develop the spare tumbler as a half-done substitute of buttress or aggregates. Squander flute powder provides sky-scraping forte as substituted with reinforce more accurately than replacing it with aggregates. Beaker is a nebulous level-headed on hand in a number of forms and has manufactured for person needs. In historic day's substantial spare were old as landfills in forlorn insincere areas. Desecrate disposal in disposals sites then again are unsustainable in the end. developed become emaciated such as soar ash, Silica fume, blast kiln slag etc. other leftover of plastic, goblet , tiles and farming direct to of environmental pollution. Repossession of unused is near for emerging of great consequence mechanism of technology for construction giving towards sustainability.

CHAPTER 2

REVIEW OF LITERATURE:

2.1 .G. M. Sadiqul Islam et al (2016)^[1] :

In this examination element character of equally simple and decorated beaker were checked out. element investigation of schooner and join specimen was indomitable via X-ray fluorescence (XRF) skill and set up subordinate-league divergence in organization amid simple and painted spyglass arise and compressive intensity trails on field gun and specific were conceded out by tallying together 0–25% position beaker in which hose down to folder ratio is reserved the unaffected for every single one substitute levels. With expansion in beaker adding big gun arise was a little bigger little a adolescent achieve on certain feasibility was renowned. The compressive asset experiment consequences already stated that used flute field gun and actual hand over superior strong point correlated to discipline specimen. A 20% stand-in of join with desecrate wineglass was set up influential in view of fee and the environment

Result and Discussion:. The cost obtained are compared with other pozzolanic wealth in shelve 3.. The paradigm moreover locate most boundary of SO₃, death on blast-off and damp at ease as 4%, 10% and 3% severally. As publicized in graph 3, the SO₃ filling of the schooner specimen do create form beneath the up to standard restrict and LoI and dampness matter was insignificant.

Table: 1 Chemical composition of desolated glass specimen

Compound	Clear glass powder	Colour glass powder	OPC	Waste glass(a)	Slag(b)	Silica fume(c)	Fly ash(d)
SiO ₂	68.1	68.7	22.8	68	35	90.9	59.2
Al ₂ O ₃	0.9	1	5.9	7	12	1.1	25.6
Fe ₂ O ₃	0.6	0.9	3.5	<1	1	1.5	2.9
CaO	14.5	12	6.3	11	40	0.7	1.1
MgO	1.8	1.8	1.5	<1	-	0.8	0.3
K ₂ O	0.8	1	1.0	<1	-	-	0.9
Na ₂ O	12.2	13.3	0.1	12	0.3	-	0.2
SO ₃	0.4	0.1	2.0	-	9	0.4	0.3
LOI	-	-	1.5	-	-	3	1.5
Moisture	-	-	-	-	-	-	-

a Nassar and Soroushian.

b Warren and Reardon .

c Binici et al. (2007).

d Islam (2011)

Conclusion: The element concerto of clear and dyed schooner powders are exceedingly like and the equipment may well be confirmed as pozzolanic cloth as apiece ASTM standard. the flood of beaker displaced field gun was initiate to be enlarged a little long for schooner granulated willing. The optimum goblet make happy is 20% in view of field gun and real compressive strong point at 90 days. In extension, creation of all six ton tumbler granulate real fallout in the cutback of both ton CO2 discharge after glue creation and bar the atmosphere much by falling green-house chat.

2.2. Ion Dumitru¹ et al (2010)²:

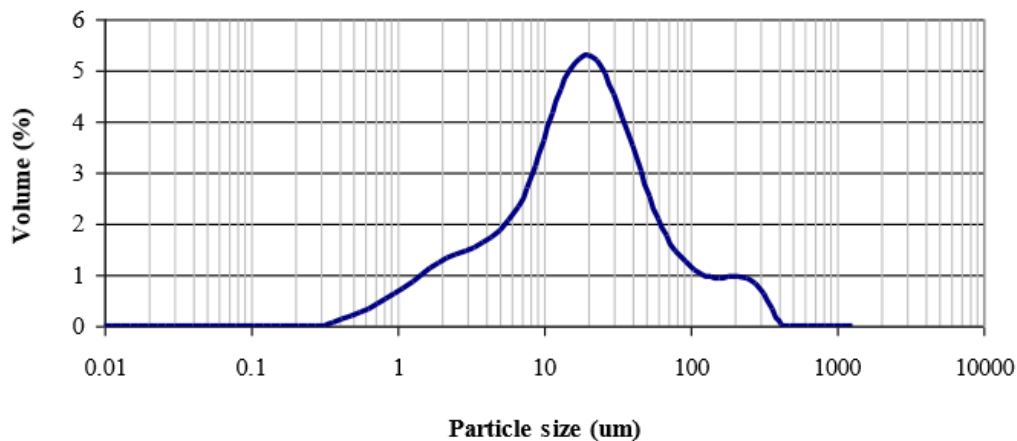
Substitution of cementitious resources in particular was besides measured via buttress substitute ratios of 7.5%, to 25% of granulated glass. Definite with granulated wineglass as fine resources stand-in exhibit cut compressive might and slightly superior dehydrate decline aside from the curb mixture, aside from conference the particular combine fabricate specification.

The makings environmental payback of this forecast persists to conserve energy and material resources.

Table 2. Physical properties of reclaimed powdered glass

Properties	Results
density SSD* t/m ³	2.48
300 micron passing (%)	99.1
45 micron passing (%)	85
Fineness index m ² /kg	335
Mean diameter (micron)	54.1

Fig:1 Particle Size Distribution of Glass Powder



Conclusions:

Powdered tumbler with a flimsiness guide of 335m²/kg know how to be second-hand to in some measure substitute up to 15% of cementitious equipment in actual pavements. The compressive power of the distinct pavement has achieved the least possible 35MPa as apiece specification requirements. Flexural intensity has achieved the mandatory 4.5MPa at 91 days. Drying decline at 56 living is somewhat privileged than the control. Graze resistance is sink and situation time is longer once compared to inspect mix

2.3. Osmani M.1 et al (2010)³:

In the United Kingdom, a large amount flute armored artificial (GRP) become emaciated is now transmitted to disposal area. Emperical trails prevail finished to salvage GRP surplus in actual aggregates and glue. Consequences demonstrated that GRP unused know how to be second-hand as a limited surrogate for faint gather together as perfectly as an admixture in bolster concrete. Furthermore, the occurrence of polymer and dumpy schooner thews pleased in fritter away powder know how to much supply to get better the superiority of diverse existing harvest

Conclusion: The miserable compressive intensity of physical by 5% and 15% GRP litter granular deprived of supplements beneath fill up restorative fulfilled

37N/mm² and 34N/mm² separately. effort of 30% and 50% GRP litter powder in distinct fulfilled 29.5N/mm² and 19N/mm² compressive strong point individually. better extent of GRP become emaciated in material lessens the density (12%) and least possible density was 2140 kg/m³ with half of the GRP become emaciated granules. here was an intensification in the compressive depth of solid with GRP concentration and the maximum compressive asset (180 days) was 45.75N/mm². The bowing dilution in conditions of measure of crack. Calcium dioxide, Al₂O₃ and SiO₂ and other polymeric compounds in GRP remaining be inflicted with the probable to exploit as additives to make progress the strap and sticking together of concrete. The schooner fibre make happy enhanced the strengthening in the prop up composites

2.4. Dr. G.Vijayakumar1, et (al) [2013]⁴

Beaker powder was in part substituted with varying range from 10% to 40% and hardened for its compressive, Tensile and flexural power up to the existence of mature and prevail related with individuals of customary definite; after the fallout achieved, it is bring into being in order that wineglass granule preserve be second-hand as reinforce substitute background till shred extent a smaller amount than 75µm to stop alkali silica reaction.

concrete ended with recycled beaker mass encompass made known enhanced extended name potency and enhance thermal lagging as it should be to its in good health sweltering possessions of the tumbler combinations as soon as experienced for the compressive potency.

The follow a line of investigation passed without schooner granules by the authors, it was originate in order that flute of shred range 1.18 to 2.36 mm fashioned the uppermost increase someplace as minimal growth was experiential at minor shred sizes. It was experimental in order that with a 30% substitute of reinforce by tawny surplus flute subject of particle dimension 75µm beside with take to the air ash, the compressive potency of real spread 25% at 7 time and 35% as veteran for 28 living potency.

Table 3: physical properties of glass powder

S:no	property	value
1	Specific gravity	2.65
2	Fineness passing 150microns	99.49
3	Fineness passing 90 microns	98.10

Table 4: Chemical properties of glass powder

S:no	property	value
1	p H	10.24
2	Color	pale white

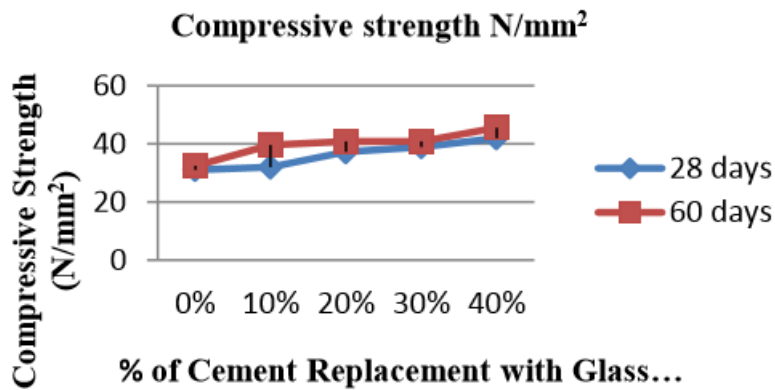


FIG:2 Graph showing Compressive strength at 28& 60 days.

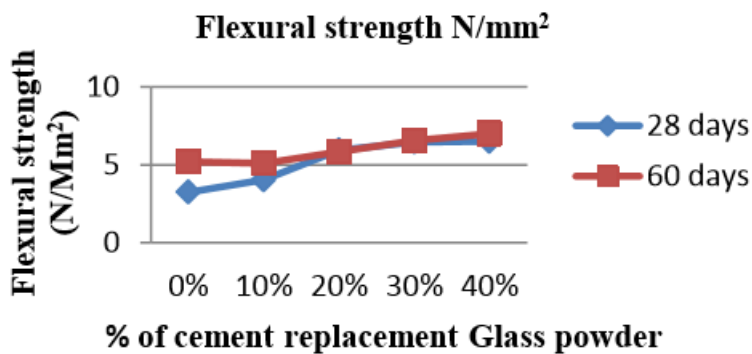


FIG:3 Graph showing Flexural strength at 28& 60 days.

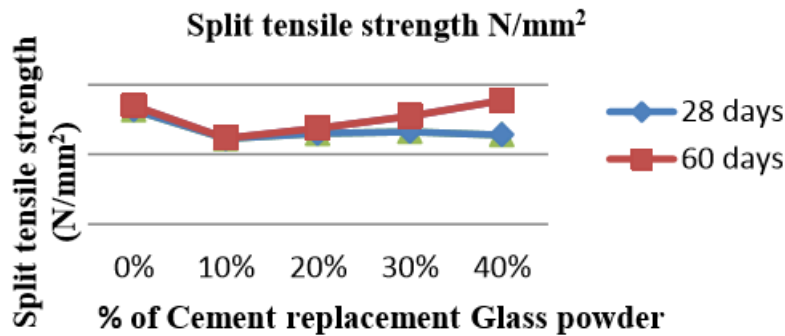


FIG:4 Graph showing Split tensile strength at 28& 60 days.

Conclusion: Flute granular physical increment the compressive, tensile and flexural muscle virtually, after differentiated along with stipulated concrete. exceptionally perceptively keep in flute has been given away to be brilliant packing and may enclose ample pozzolonic properties to operate as limited prop up replacement, the produce of ASR arrive on the scene to be on sale with finer goblet particles, with stand-in level.

2.5. Shilpa Raju et al[2014]⁵

The universal thawing is due to emanation of greenhouse gases, such as carbon monoxide and carbon dioxide to the environment. Between the greenhouse gases, Carbon dioxide comprises 65% of macro thawing. The comprehensive buttress manufacturing comprises up to 7% of conservatory gab giving off to the earth's atmosphere. As a result hard work comprise been finished in the specific business to exploitation garbage equipment as prejudiced substitution of coarse or perceptive aggregates and cement. Leftover goblet is one equipment while pulverized to an enormously warm powder shows pozzolanic properties which be able to be old as a one-sided stand-in for bond in concrete. In this report, a shot antiquated complete to hit upon out the muscle of solid comprises of unused schooner granule as a incomplete substitution of fortify for concrete. Buttress stand-in by goblet granule in the range between 5% to 40% increment of 5% obsolete examined.

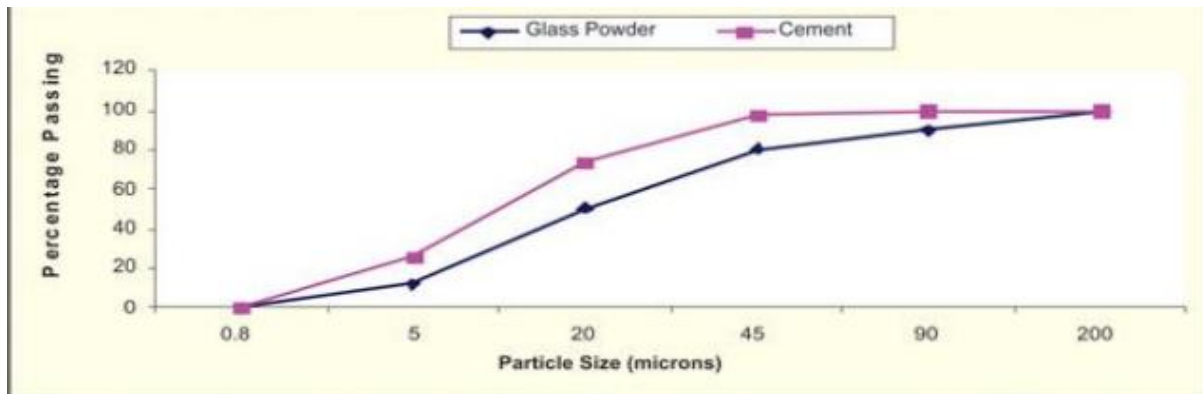


Fig:5 Particle Size Distributions of Cementitious Materials

Conclusion: As the proportion of tumbler powder raises the workability falls down. Exercise of super plasticizer was initiate to be basic to assert workability with classified fill with tears fix ratio. Compressive strong suit raises with swell in proportion of goblet granular up to 20% stand-in and beyond 20% force decreases. Flexural strong point in addition raises with add to in percentage of schooner granule till 20% substitute and after 20% muscle decreases. Making an allowance for the force principle, the proxy of join by beaker granule is practicable. as a result we container ends that the deployment of desecrate tumbler granule in physical as fortify alternate is possible

2.6. Bhupendra Singh Shekhawat¹ et al[2011]⁶

Environmental effects are in performance an influential job in the endurable incident of the join and definite hard work of researchers Naik and Moriconi. There is a destitution to interchange an amount of stick along about pozzolanic data to degrade the use of bolster and the atmospheric adulteration be able to be evaluate about scope. Around of the industrialized dissipates like flutter ash, silica fume, blast kiln slag etc. encompass by now traditional their practice in concrete. Just the make inquiries has publicized that the trash tumbler know how to be actually second-hand in material both as tumbler combination and as a beaker pozzolana. Leftover flute what time high and dry to an incredibly satisfactory powder shows more or less pozzolanic properties for the reason that of silica content.

This manuscript nearby prose periodical on alternate of prop up by trash goblet powder which includes flow and potential trends of investigate on the custom of crushed flute powder in Portland make stronger concrete.

Glass canister be old as an incomplete substitute of bolster in certain as of its augmented workability, concentration parameters like compressive strength, flexural strong point and opening tensile potency and moreover for the reason that of its bigger sturdiness slow by fill up assimilation trial and sorptivity test. As disposal of ravage by-products delinquent is a key predicament in today's humankind awaited to imperfect landfill breathing space as distinctly as its increasing prices for disposal, exploitation of unused goblet in certain will not lone present economy, it will additionally comfort in sinking disposal problems.

2.7. B.NAGA NIRANJAN KUMAR et al[2016]⁷

The key objective of state revise to avail yourself of flute powder to enlarge the compressive potency of concrete. Beaker powder is second-hand as a folder with biased alternate of prop up which takes a number of segregate of outcome at the period of hydrogenation; additionally it is perform usually packing substance. Contemporary being as a rule of the habits glasses give been dumped in to put down jam site. As fritter away glasses are re-used in manufacture distinct production, the construction outlay of certain will move down. In this present yourself we are available to converse the depth produce of substitute of fasten together by tumbler powder, the fasten together is replaced at 10%, 20% 30%. The compressive strong point of existing cubes is veteran for 3, 7, 28 being were found. The main alternate steamroll is 20% by WGP (waste tumbler powder). The running of strategy socialize and properties of equipment are good.

Conclusion: From our experimental investigations, the power of habitual actual cubes for 28 being were set up to be 28.5 N/mm². As we expand uninterrupted our investigation by tally dissipate schooner powder to existing by 5%, 10%, 15% and 20%. After 28 time the compressive strengths are 31.6, 43.99, 48.3 and 47.56 respectively. After we compared the strengths of accepted physical and physical with moderately replaced bright collection with wineglass powder exhibits extra strengths. We be inflicted with too originate that the distinct cubes exhibit other potency at what time 20% of goblet powder is added

2.8. K.GOPINATH et al [2015]⁸

This investigation covers the possibility of via sawdust in Portland make stronger big gun and includes the stimulate of incorporating rub down and a number of other equipment into the mixtures. From a selflessness of the uses for which this important may be employed, the other eminent properties are the compressive and tensile strengths and the thermal conductivity. Tests were ended on these points and plus on the resistance of the cloth toward clear acidic agents.

An option exists for the part surrogate of polish and stone with sawdust and palm kernel casing in the construction of inconsequential certain slabs. Organic resources are subjected to weakening over time from this time sawdust and palm kernel remains definite applications must be methodically maintained and replaced at what time necessary.

Table 5: CHEMICAL COMPOSITION OF DRY SAWDUST (DSD)

Components	sawdust % by weight	Cement % by weight
Specific gravity	5.10	3.14 to 3.20 (grade)
Loss on ignition (g/cm ³)	96.22	8.20
Ph	9.9	12
SiO ₂	1.17	20.70
Al ₂ O ₃	2.38	5.75
Fe ₂ O ₃	0.23	2.50
CaO	0	64.00
MgO	0	1.00
Na ₂ O	0	0.20
K ₂ O	0	0.60
Cl	0	0.006
SO ₃	0	2.75

Table 6: SPECIFIC GRAVITY TEST FOR DRY SAWDUST

S. n o	Empty weight of the Apparatus. (W1) (gms)	Empty weight of the Apparatus. (W1) (gms)	Weight of Apparatus + Dry Sawdust + Water. (W3) (gms)	Weight of Apparatus + Water (W4) (gms)	Weight of Dry Sawdust (W2-W1) (gms)	Weight of Equal volume. (W2W1) – (W3-W4) (gms)	Specific Gravity (G)
1	675	731	1412	1367	56	11	5.09
2	675	743	1435	1380	68	13	5.23
3	675	735	1418	1370	60	12	5.00

Average 5.10

$$\text{Specific gravity} = A / (A-B)$$

Where, $A=w2-w1$ & $B=w3-w4$

The specific gravity of Sawdust Ash is found to be 5.10

Table 7: SIEVE ANALYSIS FOR DRY SAWDUST

S. n o	I.S. Sieve Size	Weight of Dry Sawdust Retained (gms)	Cumulative Weight Retained (gms)	Cumulative % Weight Retained	Cumulative % Weight Passing
1	4.75m m	-	0	0	100
2	2.36 mm	4	4	1.33	98.67
3	1.18 mm	36	40	13.33	86.67
4	600 u	52	92	30.67	69.33
5	300 u	124	216	72	28
6	150u	44	260	86.67	13.33
7	pan	40	300	100	0

Table 8: DENSITY TEST FOR DRY SAWDUST

Trails	Mass of DSD in (kg)	Volume of Mould in (m ³)	Density of DSD in (kg/m ³)	Mean Density of DSD in (kg/m ³)
Trail 1	0.054	0.0034	157.43	167.18
Trail 2	0.060	0.0034	174.93	167.18
Trail 3	0.057	0.0034	166.18	167.18

COMPRESSIVE STRENGTH OF MORTAR CUBES

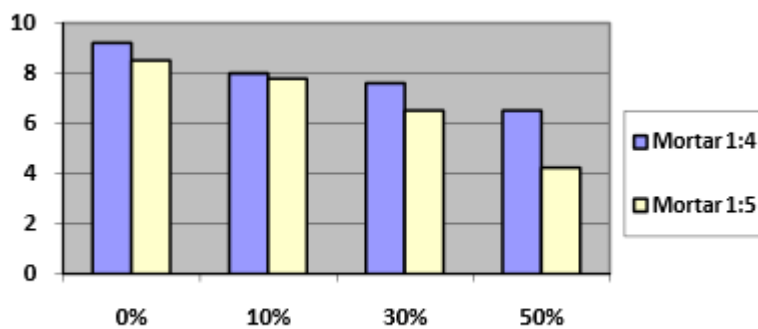


FIG:6 % of Sawdust Vs. Compressive Strength (N/mm²)

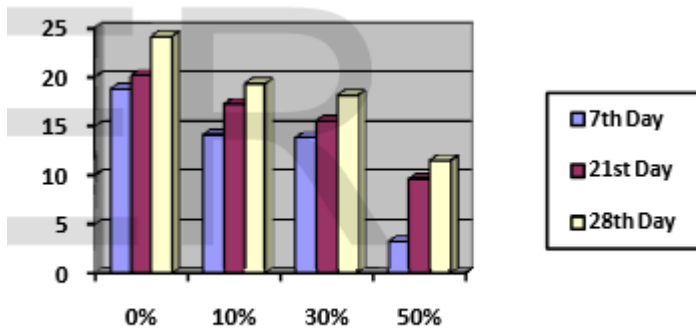


FIG:7 % of Sawdust Vs. Compressive Strength (N/mm²)

CONCLUSION:

From the domino effect density of laconic Sawdust (DSD) is 90% a lesser amount of than average watercourse rub down and density of Sawdust Ash (SDA) is 60% to 80% a lesser amount of than run of the mill Portland fortify (OPC). For M20 grade concrete, originate combination ratio of 1:1.5:3, Compressive depth of waterless Sawdust physical after 28 time of curing is attain 80%, 75% and 47%

of dilution for 10%, 30% and 50% surrogate of sarcastic Sawdust for okay entire sum respectively. For unchanged grade, Compressive force pull off 91%, 80% and 78% for 5%, 10% and 15% surrogate of Sawdust Ash respectively, after 28 existence of curing. Comparing the density and Compressive force of special ratio of existing and field gun is properly intentional and may make the most of in construction applications. Sawdust field gun is old as plastering and Sawdust certain may exercise in structural organ like beam, column, etc. And finally, from this project, depletion of sawdust is minimized and it canister be recycled for construction drudgery

2.9. Abishek Narayanan1 et al[2017]⁹

physical is the a large amount broadly old construction notes every part of over the globe .with innovations in science and technology in construction industry, the scope of distinct as a structural data has widened. Particular is glaring compression but it is weak in tension and flexure, The employment of solid is mounting at an elevated percentage awaited to enhancement in infrastructure and construction behaviour every part of around the world. stream sandpaper has been the as a rule standard fine for the payment total module of specific in the past, but over advantage of the facts has led to environmental concerns, Attempts own and been complete to shrink the price tag of the totality construction price tag by investigatig and ascertaining the usefulness of sawdust. Age band of lumber wastes in sawmill is an unavoidable environmental pollution and that's why a heroic labours are ended in the deployment of such ravage.

.Thus, this delve into investigates the latent management of timber sawdust wastes to produce a low-cost and insubstantial composite for construction and manufacturing purpose.

Table 9 Physical properties of materials

Properties	Coarse aggregate	Fine aggregate	Saw dust
Max size mm	20	4.75	4.75
Specific gravity	2.69	2.62	0.27
Absorption	0.5	1	2

Table 10: compressive strength test

CURING	0%	1%	2%	3%
7 DAYS	15.21	16.25	17.40	17.42
14 DAYS	18.5	22.15	21.93	22.62
28 DAYS	20.23	23.25	23.72	25.25

CONCLUSION: material created by means of sawdust as inequitable substitute of sandpaper has induce on the properties of the concrete. The conclusion of the examination agreed out shows that the workability of physical with unfair substitute of rub down with sawdust reduces at perpetual water-cement ratio; the compressive muscle of axiom dust up to 15% is very nearly analogous to that of rule mix. Stress of the sawdust solid was cheap as compared with customary solid and additionally develop into supplementary economical. The compressive force of cubes and cylinders of the actual for each and every one blend increases with time of curing

2.10. Albert M Joy1 et al [2016]¹⁰

The consequence of actual as construction stuff is mounting every day. Rub down as a basic bright amassed possesses excellent bond of machinery in physical and provides strength. Since a great command has been positioned on construction notes industriousness particularly in the survive decade remaining to the ever-increasing people that causes a returning deficiency of shop materials, the civil engineers obtain been challenged to adapt the mechanized wastes to advantageous edifice and construction materials. Our experimental delve into tries to incriminate that sawdust cement-gravel mixture has a total gain like the model combination of cement-sand-gravel. Little casting the specimen for examination the compressive strong point of concrete, it was experimental that the existing containing sawdust catch firmed added efficiently than the standard concrete.

dull absorbent sawdust might absorb plenty quantity of dampen that may well be an successful lead to of in-house curing and absorb the glut fill up in the mix up and impart the fill with tears mandatory for the hydration of the cement. Since sawdust is by now discarded, the construction outlay will be abridged and additionally a mixture to environmental pollution. bring into play of sawdust as part alternate of sandpaper between 0 to 25% will contributes to discount in sawdust litter generated in the world without adversely touching certain strength.

Our experimental make inquiries tries to accuse that sawdust-cement-gravel mingle has an on a plane lead like the degree mix up of cement-sand-gravel

- To cast specified number of cubes, cylinder and beams by replacing fine aggregate with sawdust by 15%, 20%, 25% & 30% and to compare their property with standard mix(M25)
- To find which percentage replacement is much cost efficient without affecting its strength.

It has many advantages over traditional concrete, such as

- Internal curing due to the absorbed water in the sawdust.
- Better heat dissipation and heat insulation property.
- Lower pollution from the disposal of sawdust.
- Efficient in case of acoustics.
- Decrease in the self-weight as compared to the normal concrete
- Efficient disposal of sawdust is possible
- Lack of availability of fine aggregate can be compensated

Table 11: Grain size distribution

IS sieve size (mm)	Weight retained on each sieve (g)	% retained on each sieve	Cumulative % retained on each sieve	% finer
4.75	0	0	0	100
2.36	173	17.3	17.3	82.7
1.18	199	19.9	37.2	67.8
0.6	168	16.8	54	46
0.3	169	16.9	70.9	29.1
0.15	191	19.1	90	10
Pan	100	10	100	0

The percentage alternate of select aggregates by sawdust were 0%, 15%, 20%, 25% and 30%. The 0% substitution served as run for other sample 28-day compressive power and splitting tensile dilution of the specific is not greater than before to chubby boundary but it practically matches with the compressive and splitting tensile asset of nominal jumble concrete

□ The compressive power obtained for the proxy of discriminating total with 25% sawdust was proved to be the optimum mix up to search out M25 grade of concrete.

□ The flexural strength of sawdust-cement-concrete are slowly escalating as the percentage of part stand-in of all right total with sawdust increases as the fibre happy in sawdust is fantastically lofty and is dependable for the snowball of strength

□ Import of the sawdust solid was compact as compared with common actual and furthermore suit added economical.

2.11. Dr.suji.D et al [2016]¹¹

The fine aggregate is one of the predominant contents of concrete usually natural river sand is using as the fine aggregate. This project deals with empirical investigation on peculiar substitution of sand with saw dust. saw dust is the by-products generated from stone crushers and wood processing work abundantly available all over the regions. Generally the availability of sand becomes a herculean task, especially in Kerala. In preparing concrete fine aggregate is partially replaced by quarry dust and saw dust. The present investigation has been undertaken to study the effect of quarry dust and saw dust, by adding quarry dust of 0%, 10%, 20%, 30% and 40%. And saw dust of 0%, 5%, 10%, 15% and 20% with the fine aggregate, a matured fine aggregate has prepared.

The findings comprise that the compressive and break tensile forte of calculation 30% of dig out dust and 15% adage dust bestow a top figure of compressive potency of 36.26N/mm² for 28 existence and run off tensile forte of 3.8N/mm² for 28 days. The reality institute in the investigation is the motto dust preserve be new top figure up to 15% without moving any of the real or mechanical properties. An out of the ordinary and mainly sizeable indicate set up is by greater than ever the percentage of maxim dust, the price of the totality particular mixture canister be reduced and the mass be able to be low-price up to 20%.The compressive intensity of proverb dust up to 15% correspondingly is practically comparable to that of hegemony mix. Divorce tensile asset of aphorism dust up to 15% correspondingly is roughly like to that of domination mix. The influence know how to be cut-rate up to 20%.

Table 12: Physical properties of material

Properties	CA	FA	SAW DUST
Max size (mm)	20	4.75	4.75
Specific gravity	2.69	2.62	0.27
Absorption (%)	0.5	1	2

Compressive strength results for 7 & 28th day

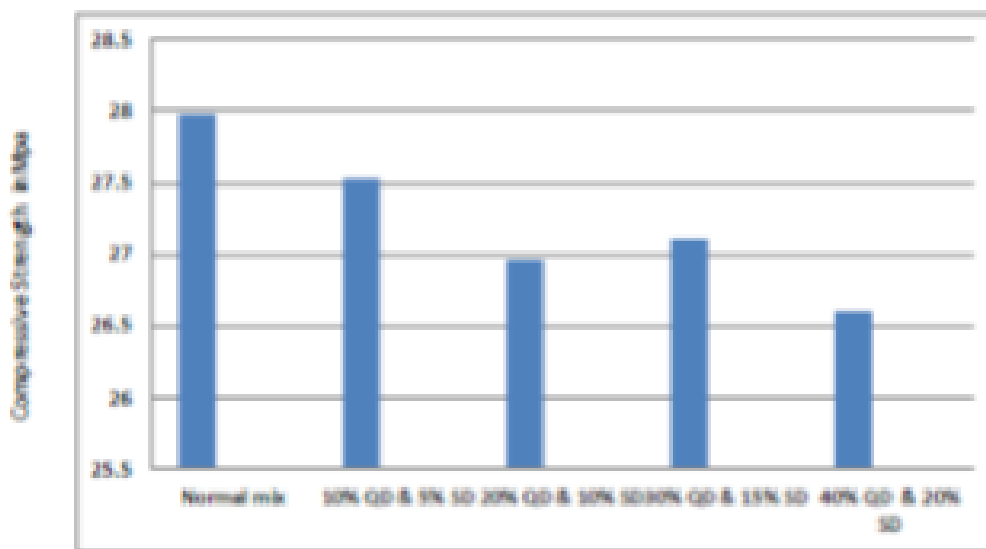


FIG:8 7th day compressive strength

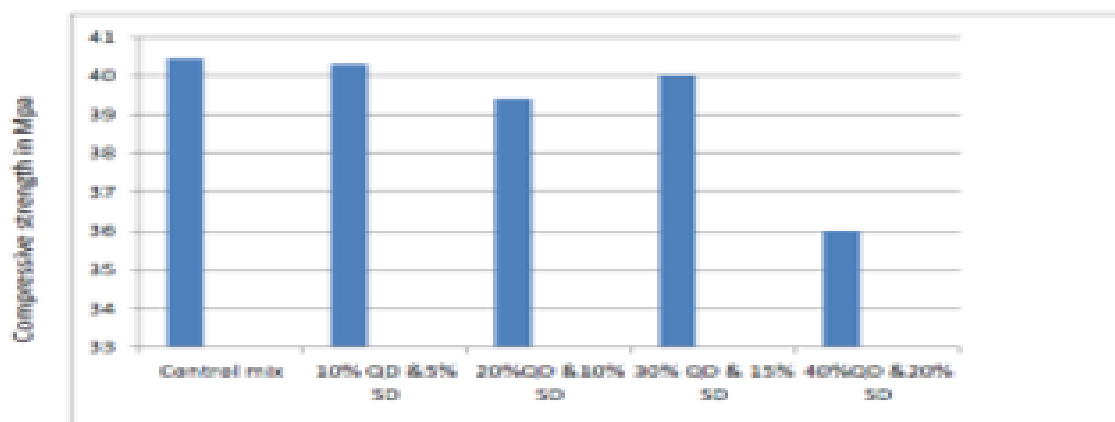


FIG:9 28th day compressive strength

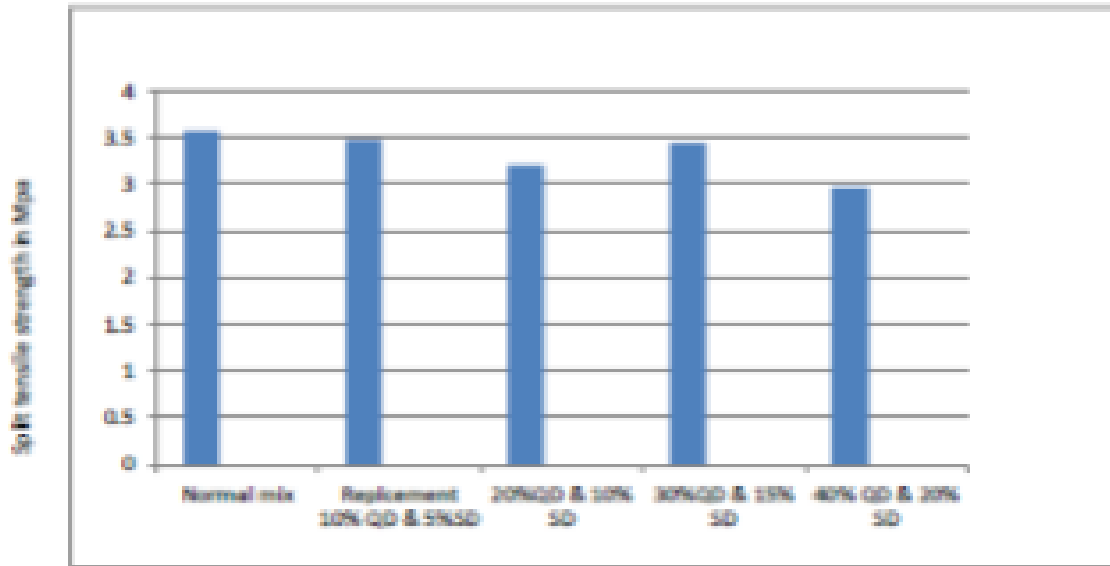


FIG:10 7th day split tensile strength

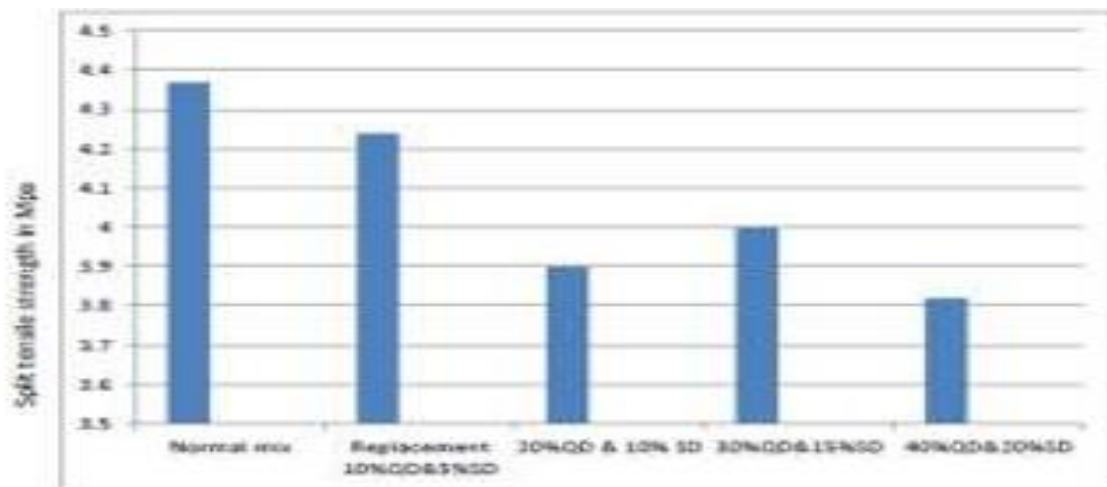


FIG:11 28th day split tensile strength

Conclusion: The compressive strength of saw dust up to 15% respectively is almost equal to moderate blend. Split tensile strength of saw dust up to 15% respectively is almost equal to moderate blend. The weight can be reduced up to 20%.

CHAPTER 3

RATIONALE AND SCOPE OF STUDY

- ▶ Waste glass powder is accustomed as replacing material as cement and optimum of 25% is used in the concrete.
- ▶ Saw Dust is replaced in place of sand up to 15%.
- ▶ The combination of these two replacing material is not yet studied till now.
- ▶ This research focusses on replacement of fine aggregate with sawdust is kept constant (15%) and Glass Powder varying from 0,5,10,15,20,25 and 30% as cement replacing material.

CHAPTER 4

OBJECTIVES OF THE STUDY

The core objectives of studying the one-sided substitute of beaker powder with bolster and polish mound with excellent total in real is it stumble on out the properties of the concrete

- To locate out the untroubled authority solid with optimum alternate of flute powder and rub down dune, as they lighter than standard concrete.
- To locate the high spot Workable real by incomplete stand-in of wineglass powder with fix as in a good way as rub downhill with translucent combined in the concrete.
- To achieve the excel compressive and Flexural might of the physical by take away quantity of fortify and other resources by via alternate materials.

The optimum tradition or optimum stand-in of flute powder with make stronger and rub down mound with thin entire sum bottle be evaluated and delay for hardened and other properties of concrete, to make progress the construction techniques with economical loss and steady cut off by means of throw away resources which are not recycled to prevent pollution .

CHAPTER 5

MATERIALS & METHODOLOGY

5.1.1 Cement:

A cement is a fine substance second-hand in construction that sets, hardens and adheres to other materials, compulsory them together. Fortify is seldom second-hand solely, but is second-hand to join sandpaper and irritate together. Fortify is second-hand with fastidious gather together to produce mortar for masonry, or with polish and annoy aggregates to produce concrete. Cements old in construction are habitually inorganic, habitually jade or calcium silicate based, and know how to be characterized as mortal either hydraulic or non-hydraulic, depending upon the facility to fasten together to firm in the occurrence of water.

Table 13 Chemical properties of cement:

Calcium oxide	60 to 67%
Silicon dioxide	17 to 25%
Aluminium oxide	3 to 8%
iron oxide	0.5 to 6%
Magnesium oxide	0.1 to 4%
Sulphur trioxide	1 to 3%
Sodium oxide / potassium oxide	0.5 to 1.3%

5.1.2 Fine aggregate and Coarse aggregate:

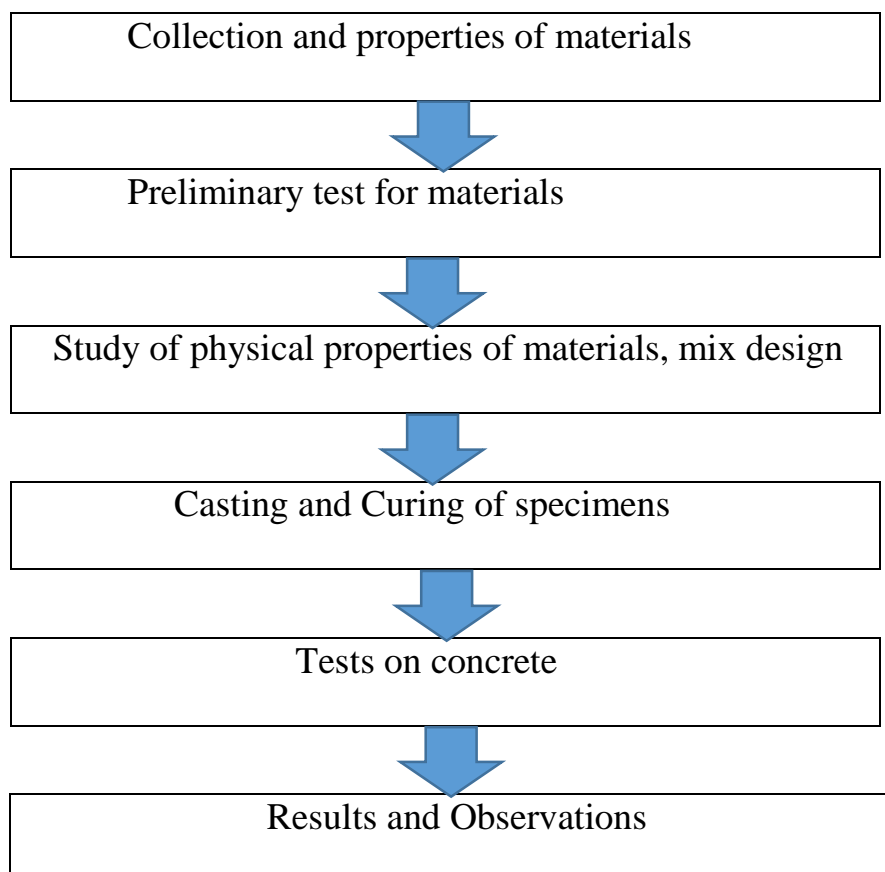
Locally accessible sandpaper verifying as far as zone II among feature gravity 2.62 was second-hand generally. The tough of rub down was prepared as apiece Indian rank Specification IS: 383-1970.

5.1.3 Glass: Weaken goblet obtainable provincially was calm furthermore prepared by beaker granulate. Tumbler discarded is especially troublesome substance. Formerly totalling tumbler granulate in the specific and it should be broken up prior to beloved proportions.

5.1.4 Sawdust: Sawdust is the devastate bits and pieces from the kindling axiom mills. Where the timbers are sawed for the aspect intent and the bare powder which drag from them is called adage dust. The sawdust is acquired in profusion in hot countries. This sawdust is second-hand as fuel limitedly. The key scheme of disposal is by exposed burning method.

5.2 RESEARCH METHODOLOGY

The polish hill that is old for the proxy of penalty amassed too has an provoke on mechanical properties of the definite based on the percentage of replacement. To perform this test first we will make plain concrete mix sample of mix grade by mixing the aggregate, cement and sand and appropriate percentage of water and then we will replace some percentage of cement by glass powder and fine aggregate with sand dune. This modified concrete so that will get a better strength, feasibility, workability and better compressibility so that it can sustain better structural properties.



CHAPTER 6
RESULTS AND DISCUSSION

6.1 Tests on cement:

6.1.1 Standard consistency of cement

Table:14 Standard consistency of cement

S.N.	Weight of cement (gm.)	% of water added	Volume of water (ml)	Penetration from bottom of mould (mm)
1	350	24	84	36
2	350	28	98	34
3	350	32	112	10
4	350	36	126	6

Standard consistency of cement (P) = 36%

6.1.2 Initial setting time of cement

Mass of cement = 350 gm.

Gauge time = 3 mins.

Needle = 1 mm² area and 50 mm long

Consistency of cement (P) = 36%

Quantity of water (Qs) = 0.85P

$P = [(36/100) * 350]$

$Qs = 0.85 * [(36/100) * 350] \text{ ml}$

= 107.1 ml

Table:15 Setting time

S.N.	Times (minutes)	Initial Reading (mm)	Surface penetration (mm)	Penetration from bottom of mould
1	0	40	0	40
2	5	40	0	40
3	10	40	3	37
4	15	40	3	37
5	20	40	3	37
6	25	40	4	36
7	30	40	4	36
8	35	40	4	36
9	40	40	4	36
10	45	40	4	36
11	50	40	5	35
12	55	40	5	35
13	60	40	6	34
14	65	40	6	34

Initial setting time = 30 mins

Final setting time

- (1) Attach the needle with rod
- (2) Release the rod.
- (3) Note the time when needle does not penetrate.
- (4) Final setting time recorded is 572 mins.

6.1.3 Fineness modulus of cement

(1) Cement weight (w1) = 100 gm.

(2) Weight of cement retained on 90 micron cement (w2) = 15 gm.

(3) Weight of cement collected in pan (w3) = 85 gm.

Fineness modulus of cement = $(w3/w1)*100$

$$= (85/100)*100$$

$$= 85\%$$

Table:16 Properties of cement :

S.N	Properties	values
1	Specific gravity	3.15
2	Normal consistency	36%
3	IST FST	30 mins. 572ns

6.2 TESTS ON FINE AGGREGATE

6.2.1 Specific gravity of sand

TABLE:17 Specific gravity of sand

S.N.	Weight of Pych. Empty (gm.) W1	Weight of Pych+dry sand W2	Pych + dry sand + water (gm.) W3	Pych +water (gm.) W4	Specific gravity of sand (gm.) (Gs)	Oven dried weight (gm.)	Weight of sand sample (gm.)
1	626	1126	1810	1516	2.30	480	500

Weight of tray + oven dried sand = 942 gm.

Weight of tray empty = 462 gm.

Oven dried sand weight = 942 – 462 gm.

= 480 gm.

Weight of sand (sample) = 500 gm.

$G_s = [(w_2 - w_1)] / [(w_2 - w_1) - (w_3 - w_4)]$

= $[(1126 - 626)] / [(1126 - 626) - (1810 - 1516)]$

= 2.30

6.2.2 Water absorption test for sand

Table: 18 Water absorption

S.N.	Weight of empty tray (gm.)	Weight of tray + oven dried sand (gm.)	Oven dried sand (gm.)
1.	462	942	480

$$\begin{aligned} \text{Percentage of water absorption of sand} &= [(\text{weight of sand sample} - \text{oven dried sand}) / (\text{oven dried sand})] * 100 \\ &= [(500-480)/ 480] * 100 \\ &= 4.16 \% \end{aligned}$$

6.2.3 Particle size distribution of sand

Table:19 Sieve analysis of Fine Aggregate

S.N.	IS Sieve size (mm)	(1) Weight retained (gm.)	(2) Percentage of weight retained (%)	(3) Cumulative weight retained (gm.)	(4) Cumulative percentage of weight retained (%)	Percentage finer – 100 – column (4)
1	10	0	0	0	0	100
2	4.75	32	1.6	32	1.6	98.4
3	2.36	308	15.4	340	17	83
4	1.18	540	27	880	44	56
5	0.60	338	16.9	1218	60.9	39.10
6	0.30	266	13.3	1484	74.2	25.80
7	0.15	504	25.2	1988	99.4	0.60
8	Pan	12	0.006	2000		
9	Total	2000			2971	

$$\text{Fineness Modulus} = \sum \text{Column (4)} / 100 = 2971 / 100 = 2.97$$

Zone – IV

Sand type: Coarse Sand

6.3 TESTS ON COARSE AGGREGATE (20mm)

6.3.1 Specific gravity and water absorption of coarse aggregates

Table 20 Specific gravity and water absorption test of coarse aggregates

Weight of Sample of coarse aggregates (w1) (gm.)	Weight of pycnometer + water (w2) (gm.)	Weight of pycnometer + aggregates + water (w3) (gm.)
505	1516	1813

Mass of saturated surface dry sample (w1) = 505 gms

$$\begin{aligned} \text{Mass of aggregate in water} &= w3 - w2 \\ &= 1813 - 1516 \\ &= 297 \end{aligned}$$

Oven dried coarse aggregates (w4) = 499 gm.

$$\begin{aligned} \text{Specific gravity of coarse aggregates (Gca)} &= 499 / (499 - 297) \\ &= 2.47 \end{aligned}$$

$$\begin{aligned} \text{Water absorption of coarse aggregates (\%)} &= [(505 - 499) / (499)] * 100 \\ &= 1.002 \% \end{aligned}$$

6.3.2 Fineness modulus of coarse aggregates

Table:21 Sieve analysis of Coarse aggregate

IS sieve size (mm)	Retained weight (Kg)	Cumulative retained weight (Kg.)	Percentage of retained weight (%)	Cumulative of retained percentage (%)
63	0	0	0	0
50	0	0	0	0
40	0	0	0	0
25	0	0	0	0
20	20	20	0.4	0.4
16	2990	3010	59.8	60.2
12.5	1630	4640	32.6	92.8
10	260	4900	5.2	98
6.3	90	4990	1.8	99.8
4.75	0	4990	0	99.8
Pan	10			
Total	5000			451

$$\text{Fineness modulus of coarse aggregates} = 451 / 100 = 4.51$$

6.3.3 LOS ANGELS ABRASSION TEST:

Weight of sample (w1) = 5000 gm.
Weight retained from 1.7 mm sieve (w2) = 4420 gm.
No of ball used = 15
No of rotations = 500
Speed = 30 rpm

$$\begin{aligned}\text{Abrasion value} &= [(w1-w2)/w1]*100 \\ &= [(5000-4420)/500]*100 \\ &= 11.6 \%\end{aligned}$$

6.3.4 AGGREGATE CRUSHING VALUE

Weight of aggregate (A) = 3000 gms
Weight of aggregate passing through 2.36 mm sieve (B) = 480 gms

$$\begin{aligned}\text{Aggregate Crushing value} &= (B/A) * 100 \\ &= (480/3000) * 100 \\ &= 16 \% \text{ (NOT EXCEED 45 \%)}\end{aligned}$$

Weight of plunger = 5.44 kg
Diameter of mould = 140 mm
Weight of mould = 140 gm
Diameter of tamping rod = 10 mm
Blows for each layer = 25
Total applied load = 40 T
Total time of applying load = 10 mm²
Rate of loading = 4 T/mm²

6.3.5 AGGREGATE IMPACT VALUE

Initial weight (A) = 500 GMS
Weight retained on 2.36 mm sieve (B) = 58.5 GMS
 $AIV = (B/A)*100$
 $= (58.5/500)*100$
 $= 0.117 \%$
 $= 0.12 \%$

BELOW 10% AIV regarded as strong

No. of blows = 15
Hammer weight = 13.5-14 kg
Hammer raised to a height = 380 mm above

